20220 Sheet

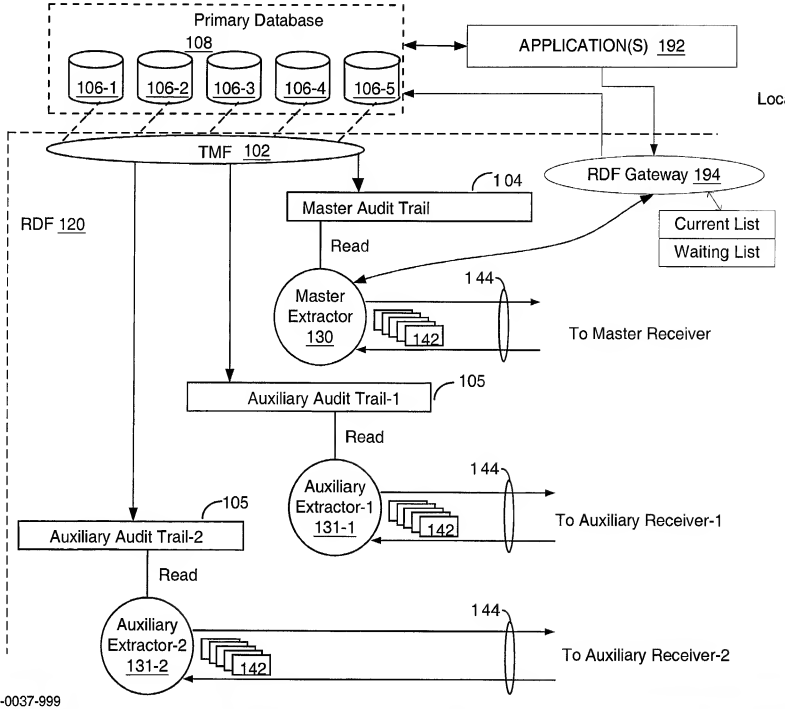



Fig. 1A

20220 Strsont

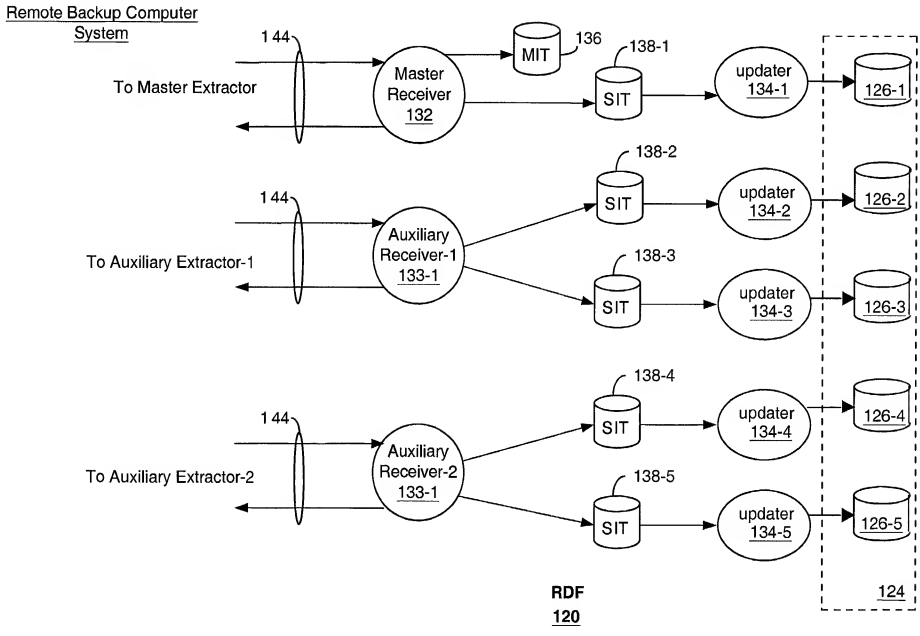



Fig. 1B

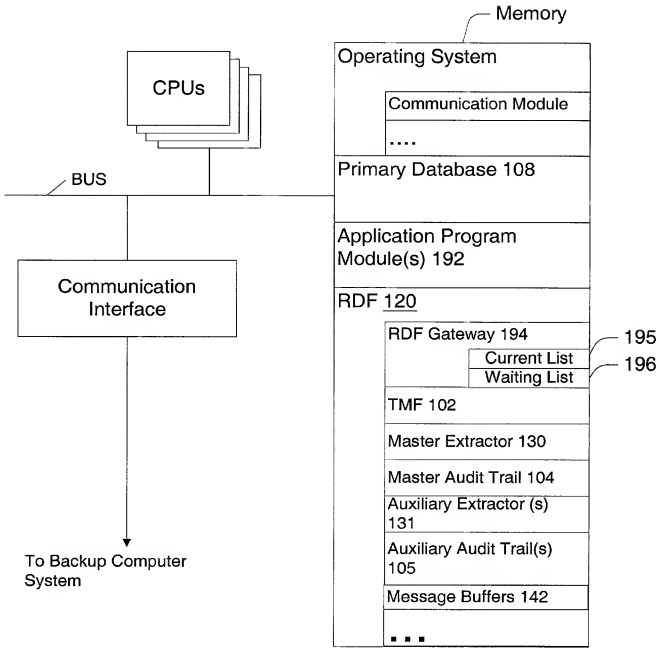

Local Primary Computer System
Memory
CPUs
Operating System
Communication Module
....
BUS
Primary Database 108
Application Program Module(s) 192
Communication Interface
RDF 120
RDF Gateway 194
Current List
Waiting List
195
196
TMF 102
Master Extractor 130
Master Audit Trail 104
Auxiliary Extractor (s) 131
Auxiliary Audit Trail(s) 105
Message Buffers 142
To Backup Computer System

Fig. 1C

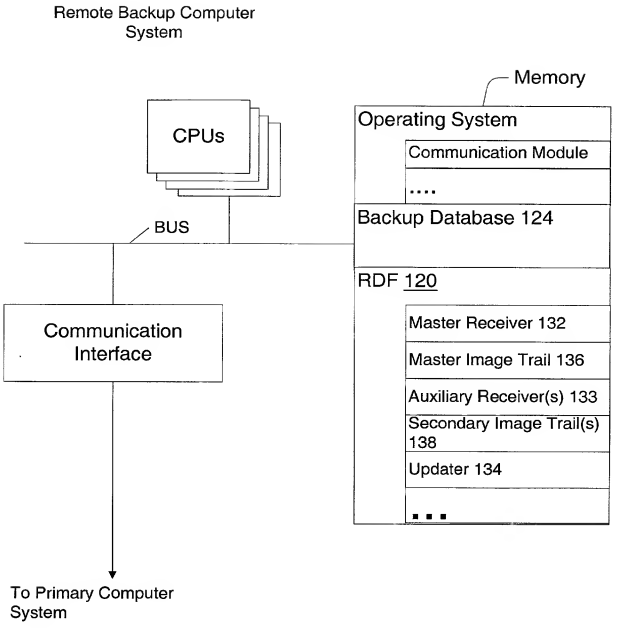

Remote Backup Computer System
Memory
CPUs
Operating System
Communication Module
....
BUS
Backup Database 124
RDF 120
Master Receiver 132
Master Image Trail 136
Auxiliary Receiver(s) 133
Secondary Image Trail(s) 138
Updater 134
...
Communication Interface
To Primary Computer System

Fig. 1D

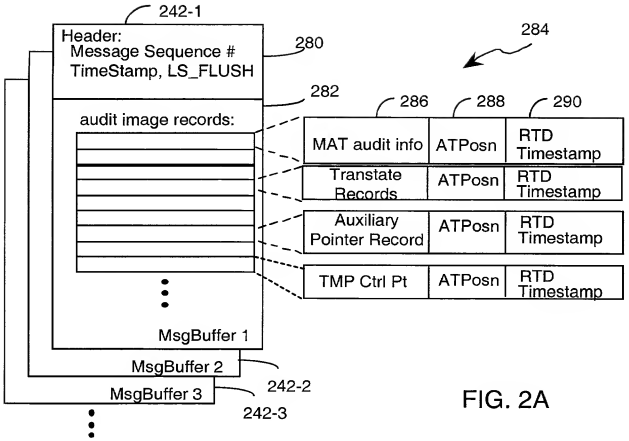

242-1
Header:
Message Sequence #
TimeStamp, LS_FLUSH
280
284
282
286
288
290
audit image records:
MAT audit info
ATPosn
RTD Timestamp
Transtate Records
ATPosn
RTD Timestamp
Auxiliary Pointer Record
ATPosn
RTD Timestamp
TMP Ctrl Pt
ATPosn
RTD Timestamp
MsgBuffer 1
MsgBuffer 2
242-2
MsgBuffer 3
242-3

FIG. 2A

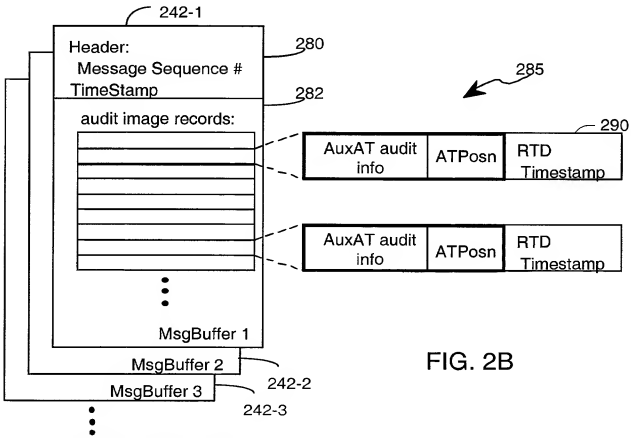

242-1
Header:
Message Sequence #
TimeStamp
280
285
282
290
audit image records:
AuxAT audit info
ATPosn
RTD Timestamp
AuxAT audit info
ATPosn
RTD Timestamp
MsgBuffer 1
MsgBuffer 2
242-2
MsgBuffer 3
242-3

FIG. 2B

20220°SH19801

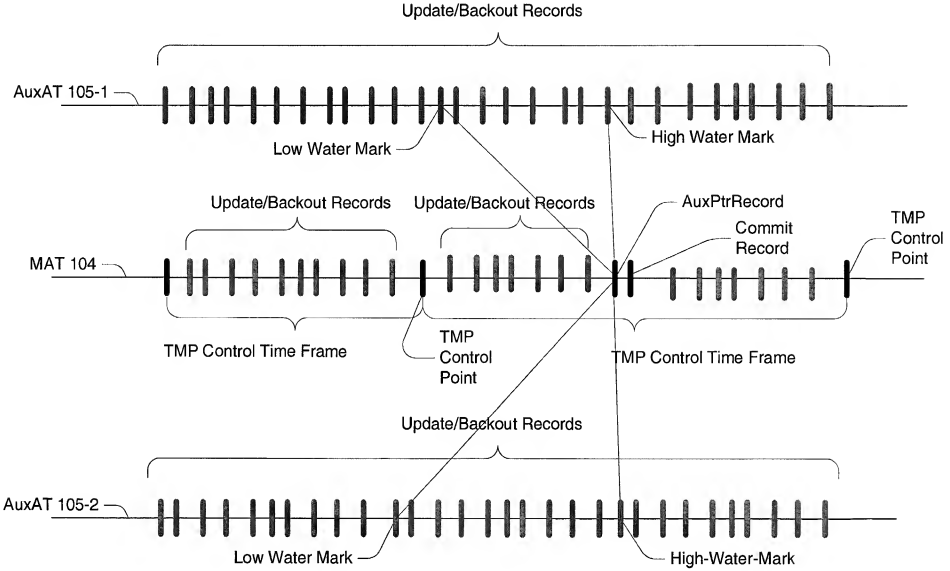
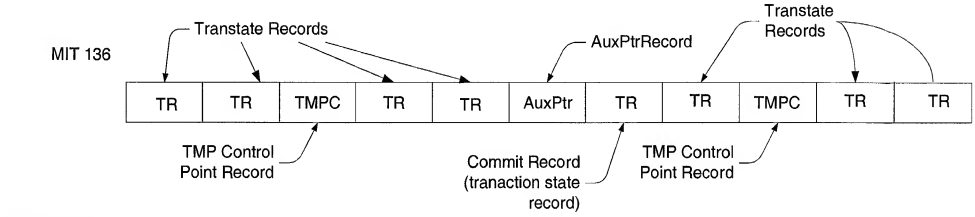
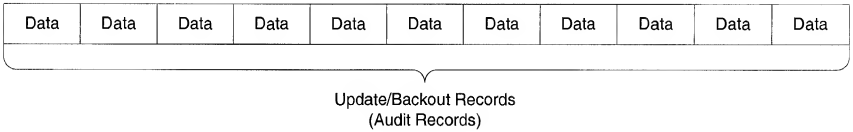



Fig. 3

20220 SH1950T




MAT-based SIT 138-1




AuxAT-based SIT 138-3

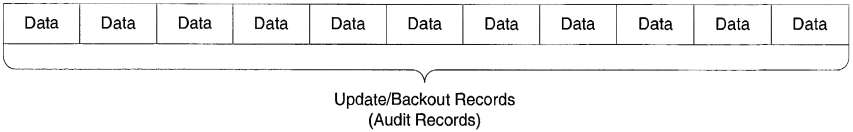



Fig. 4

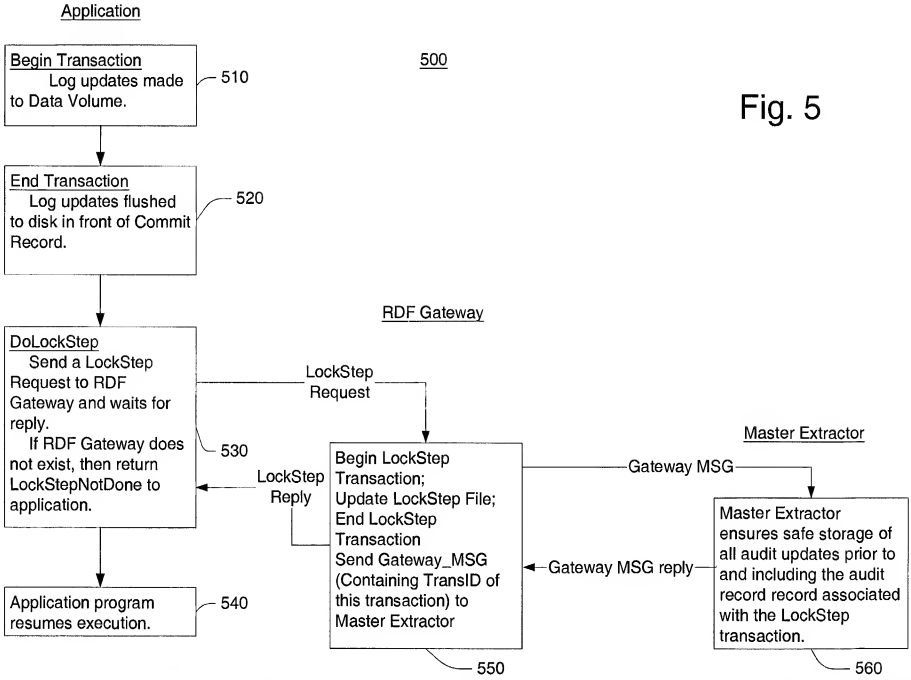

Application
Begin Transaction
Log updates made to Data Volume.
510
500
End Transaction
Log updates flushed to disk in front of Commit Record.
520
RDF Gateway
DoLockStep
Send a LockStep Request to RDF Gateway and waits for reply.
If RDF Gateway does not exist, then return LockStepNotDone to application.
530
LockStep Request
LockStep Reply
Master Extractor
Begin LockStep Transaction;
Update LockStep File;
End LockStep Transaction
Send Gateway_MSG (Containing TransID of this transaction) to Master Extractor
550
Gateway MSG
Gateway MSG reply
Master Extractor ensures safe storage of all audit updates prior to and including the audit record record associated with the LockStep transaction.
560
Application program resumes execution.
540

Fig. 5

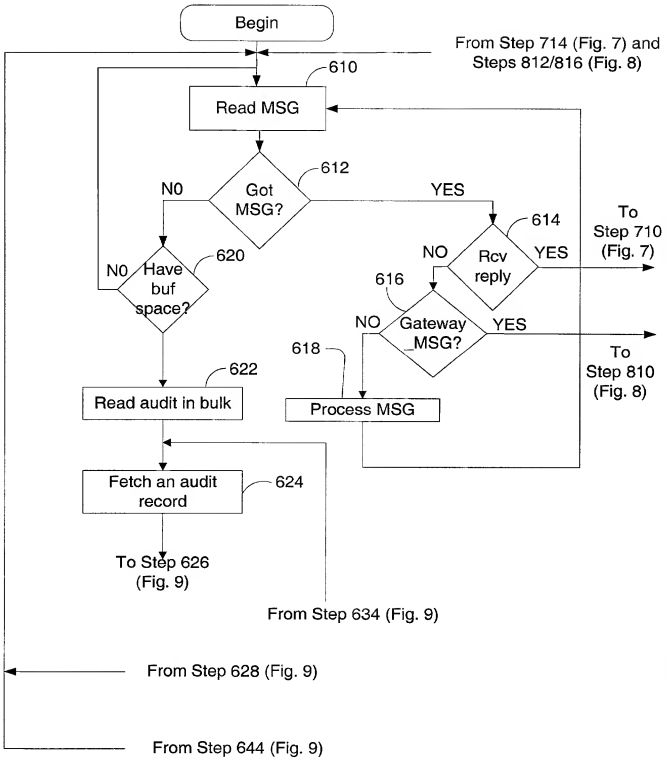

Begin
From Step 714 (Fig. 7) and Steps 812/816 (Fig. 8)
610
Read MSG
612
Got MSG?
N0
YES
614
Rcv reply
NO
YES
To Step 710 (Fig. 7)
620
Have buf space?
N0
616
Gateway _MSG?
NO
YES
618
To Step 810 (Fig. 8)
622
Read audit in bulk
Process MSG
Fetch an audit record
624
To Step 626 (Fig. 9)
From Step 634 (Fig. 9)
From Step 628 (Fig. 9)
From Step 644 (Fig. 9)

FIG. 6

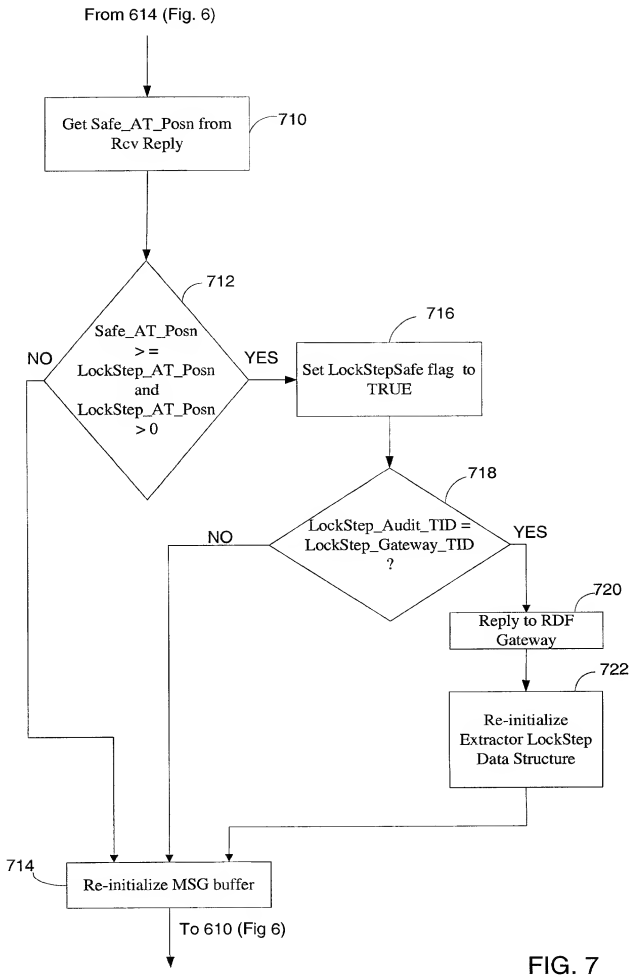

From 614 (Fig. 6)
Get Safe_AT_Posn from Rcv Reply
710
712
Safe_AT_Posn >= LockStep_AT_Posn and LockStep_AT_Posn > 0
NO
YES
716
Set LockStepSafe flag to TRUE
718
LockStep_Audit_TID = LockStep_Gateway_TID ?
NO
YES
720
Reply to RDF Gateway
722
Re-initialize Extractor LockStep Data Structure
714
Re-initialize MSG buffer
To 610 (Fig 6)

FIG. 7

10564500

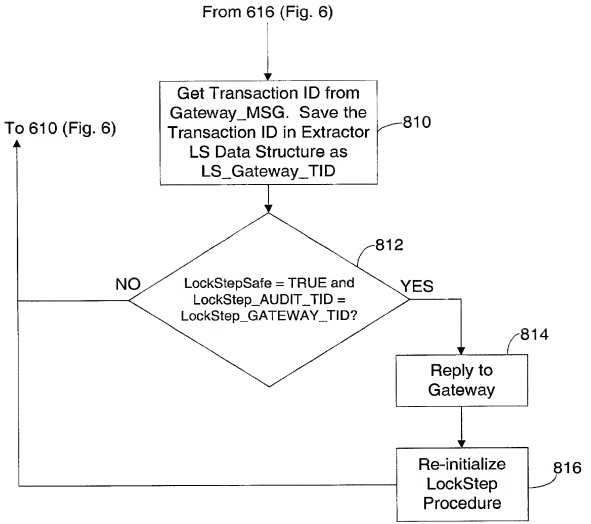



FIG. 8

20220'SHT9S00T

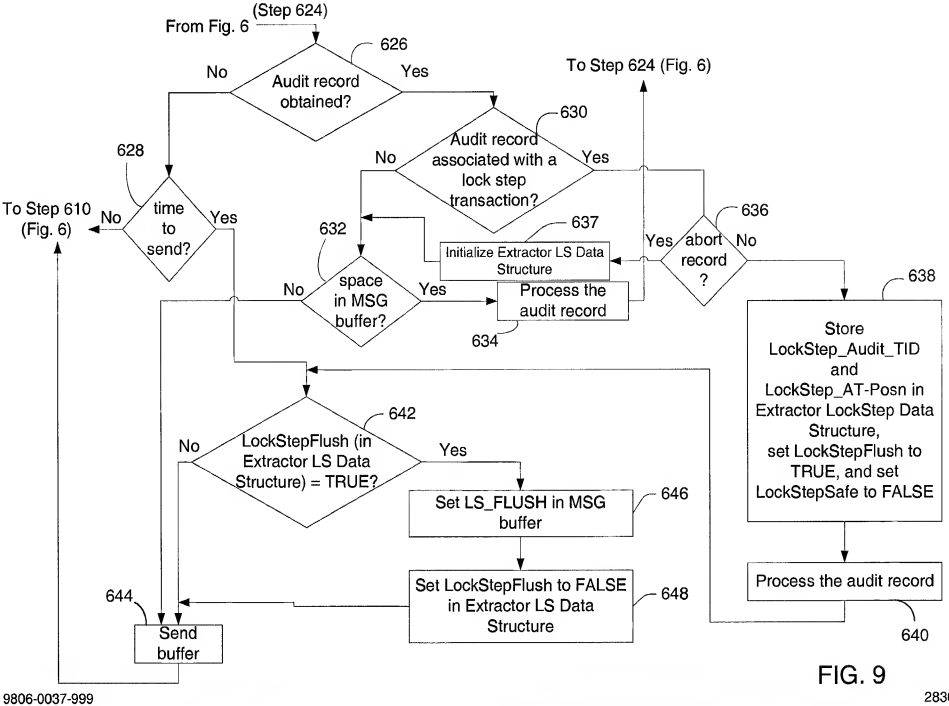



FIG. 9

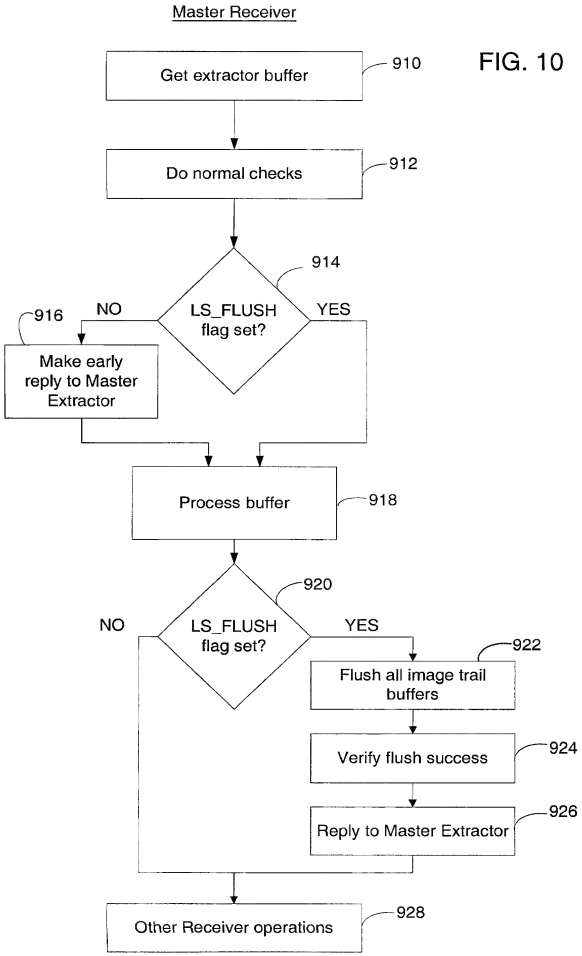

Master Receiver
Get extractor buffer
910
Do normal checks
912
914
LS_FLUSH flag set?
NO
YES
916
Make early reply to Master Extractor
Process buffer
918
920
LS_FLUSH flag set?
NO
YES
922
Flush all image trail buffers
Verify flush success
924
Reply to Master Extractor
926
Other Receiver operations
928

FIG. 10

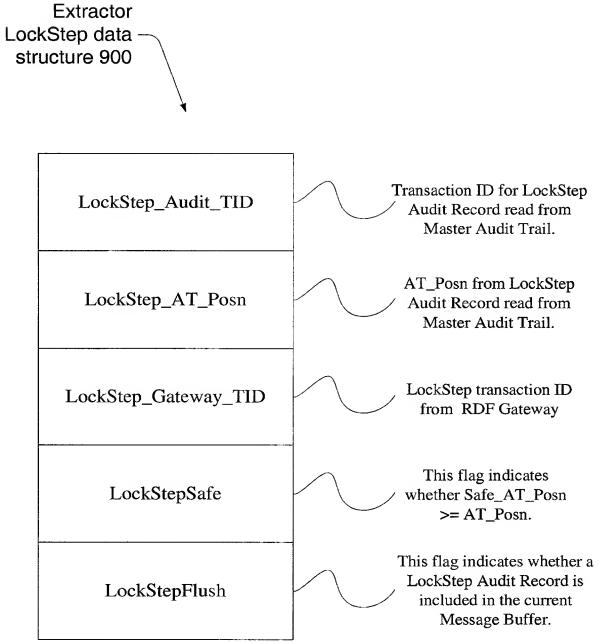

Extractor
LockStep data
structure 900
LockStep_Audit_TID
Transaction ID for LockStep Audit Record read from Master Audit Trail.
LockStep_AT_Posn
AT_Posn from LockStep Audit Record read from Master Audit Trail.
LockStep_Gateway_TID
LockStep transaction ID from RDF Gateway
LockStepSafe
This flag indicates whether Safe_AT_Posn >= AT_Posn.
LockStepFlush
This flag indicates whether a LockStep Audit Record is included in the current Message Buffer.

FIG. 11